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SEPP11.001AU PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Sven Lindfors	) Group Art Unit: 1765
Appl. No.	:	09/836,674	)
Filed	:	April 16, 2001	)
For	:	METHOD AND APPARATUS OF GROWING A THIN FILM ONTO A SUBSTRATE	)
Examiner	:	Song, Matthew J	)

DECLARATION UNDER 37 C.F.R. §1.131

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

1. The following declaration is directed to establishing invention of the subject matter of Claims 1-26 of the above-referenced application prior to the effective date of U.S. Patent No. 6,305,314.

2. I am the inventor of the subject matter claimed in the above-referenced application.

3. I have read the Office Action mailed on July 25, 2002 in which the Examiner rejected Claims 1-20 and 22-25 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,305,314 and Claims 14-15, 19, 21, and 16 under 35 U.S.C. 103(a) as being obvious over U.S. Patent No. 6,305,314 in combination with various other references.

4. Before December 17, 1999 (the effective filing date of U.S. Patent No. 6,305,314), I reduced to practice a method for growing a thin film on a surface of a substrate in a reaction chamber according to the ALD method, the method comprising feeding a pulse of a first vapor phase reactant into the reaction chamber; reacting the first vapor phase reactant with the surface

of said substrate to form a thin film on said substrate, wherein residual first vapor phase reactant remains in the reaction chamber; and feeding a pulse of a second vapor phase reactant into the reaction chamber, wherein the second vapor phase reactant reacts with the residual first vapor phase reactant to form a solid reaction product in said reaction chamber.

Before December 17, 1999 (the effective filing date of U.S. Patent No. 6,305,314), I also reduced to practice an apparatus for growing thin films on a substrate by subjecting the substrate to alternately repeated surface reactions of vapor phase reactants according to the ALD method. The apparatus comprising a pre-reactor; a reaction chamber into which the substrate can be disposed, wherein the pre-reactor is arranged immediately upstream of said reaction chamber; a plurality of inflow channels communicating with the reaction chamber, wherein the inflow channels are adapted to feeding the vapor phase reactants in the form of vapor-phase pulses into said reaction chamber; and at least one outflow channel communicating with the reaction chamber, the outflow channel being adapted for the outflow of reaction products and excess amounts of the vapor phase reactants from said reaction chamber, wherein the pre-reactor forms a first reaction zone, in which the reactants of successive vapor-phase pulses can be reacted with each other in the vapor phase to form a solid reaction product, wherein the reaction chamber forms a second reaction zone that can be operated under conditions conducive to ALD growth of a thin film.

The reduction to practice is evidenced by the attached drawing of a pilot reactor and the attached test data taken from the pilot reactor. The pilot reactor illustrated in the attached drawing and the test data were created in Keilaramta, Espoo Finland before December 17, 1999. The exact dates have been redacted from the attached documents.

5. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Appl. No. : **09/836,674**
Filed : **April 16, 2001**

S. Lindfors

Sven Lindfors

January 17, 2003

Date

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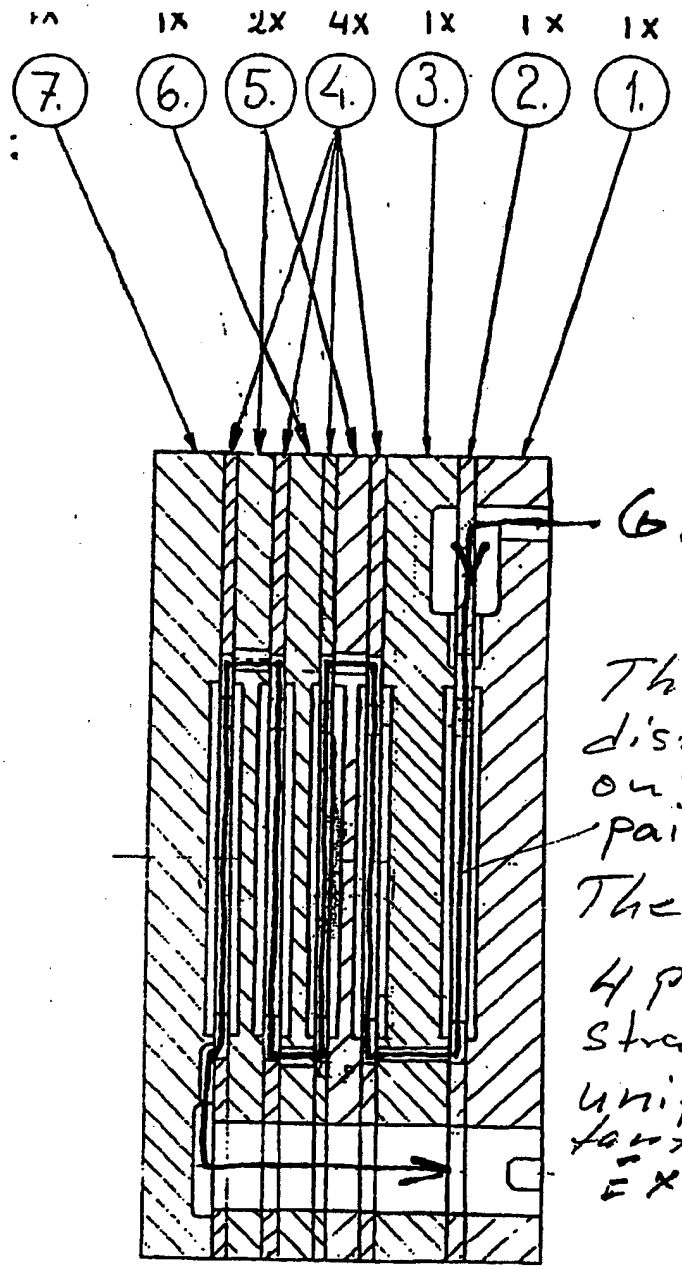
121602



The growth disturbance on the first pair of glasses. The following 4 pair of substrates will be uniform if reactants available.

Exhaust.

Sh

See enclosed run Z731

Osa	Piirustusnumero / Tavaratunnus	Osan tai kokoonpanoryhmän nimitys	Standardi tai luettelo	Muoto, malli, määrä / Lajimerkki	Laatu	Kpl
Yleistoleranssit: SFS 4011 Vaski		Mittakaava: 1:1	Tuote	Liittyy	Mate. Quartz Assy. Drawing	
Piirt. 28.05.90 V Kalm		Pilot plant Reactor			Ent.	Uusi
Suunn. Sh					25.00.030.40	
Tark. 29.05.90 Sh		Massa				
Hyv.						

ASM MICROCHEMISTRY OY

p. ⑧ pilot pack 6 substrates

Material: TiO2 Operator: SLi Run:3731

Comments: IB-pohjat
TiCl4 6 kierr. auki t=25'C
H2O 6 kierr. auki t=25'C
pilot pakka 6 substr.

P0:5.0 mb
F1:0.3 slm
F2:0.1 slm

	Substr. temp./ C'			Source temperatures / C'					Vapor source/SCCM		
Zone	8	7	6	5	4	3	2	1	A	B	C
Heater	0	476	476	476	0	0	0	0			
Inside	0	0	0	400	0	0	0	0			

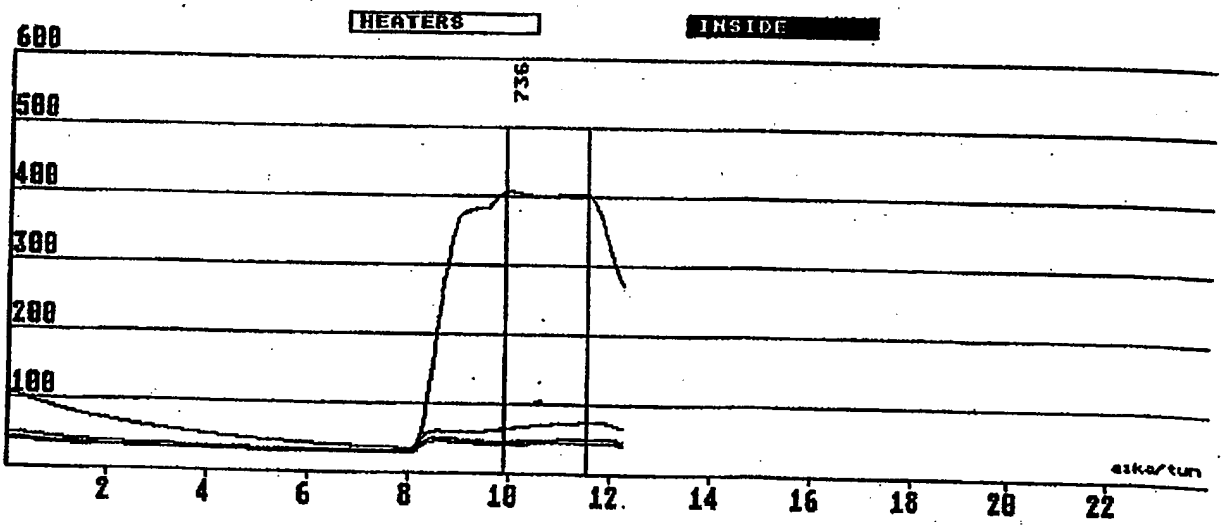
Seq 3	Seq 2	Seq 1	Water Valve	Ti	N2	H2O	N2
				7	3	8	6
		3000		2/8	2/8		
						2/8	2/8

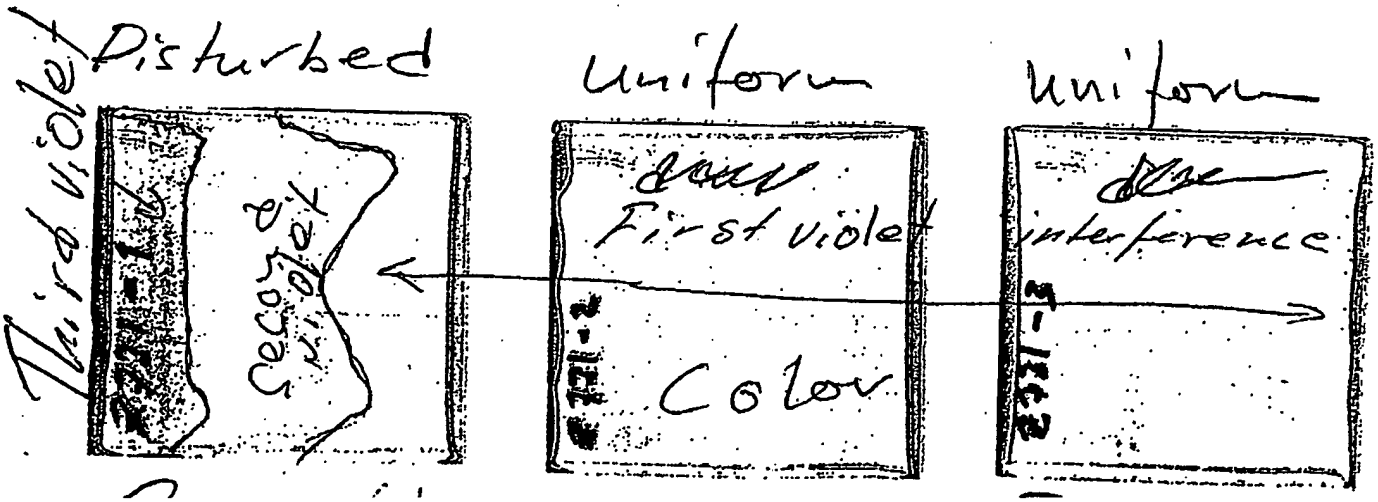
COOL

12:16:34

NR	1	2	3	4	5	6	7	8
HEATER	37	52	61	83	128	201	130	73
INSIDE		42	47	65	270			
NOM.								

COOL	SLOW HEAT.
FLOW PRI	0.30 SLM
FLOW SEC	0.10 SLM
PRESSURE	3.9 MBAR
FLOW SRC	0.04 SCCM





Dear Raj:

I spooked with Vesa this morning about the uniformity problem. I send you with this fax some information regarding the useful uniform area on the substrate. Chris Langdon was informed in the specifications of F-120 that the uniform area begins 20 mm after the front edge of the substrate.
I'm sure dr. Suntola will take up this matter with you and then we can decide what to do.

First, the TiO2 reference runs, where you can see the difference of introducing the reactants either from opposite sides or from the same side. Run 759 is completely uniform and run 748 has a non uniform area in the front side of the glas.

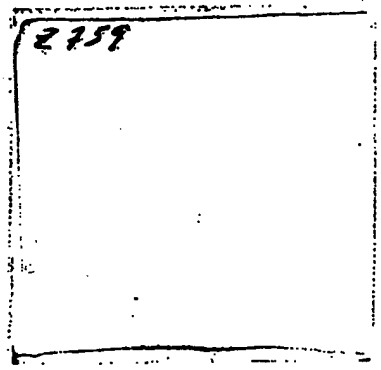
The non uniform edge of the glas 748 is not " abnormal". The reactor is designed like this to prevent the growth on the quarts parts and by that reducing the need of cleaning the parts. When the materials are feed from opposite sides, the purge of the gas channels and the spreading chamber, in-between the material pulses, will take most of the excess material away, but there will always remain a tail that gives some vapor pressure. So , we end up with a CVD situation where the remainder from the first reactant will react with the following reactant in a conventional CVD mode, where both of the reactants are available in the gas phase simultaneously.

The second drawing shows a "pilot reactor head" where its possible to run up to ten (10) substrates in the same run. I tried to copy the appearance of the samples to show you how the first pair of glasses will take the disturbed growth and the following glasses are uniform from the very front edge as long as there is reactants available.

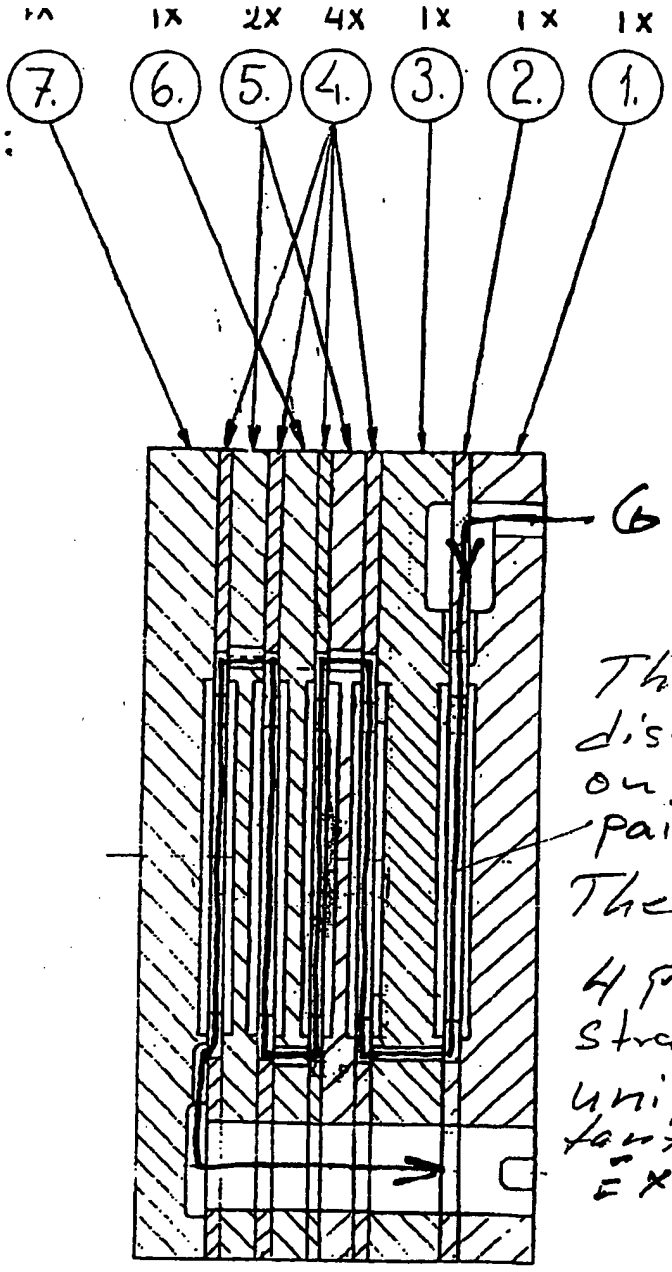
Best regards

Sven Lindfors

TiO_2 reference run.



Materials from Same side / Materials from ~~other~~ opposite sides.



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Yleistoleranssit: SFS 4011 Vaski		Mittakaava: 1:1	Tuote:	Liittyy:	Mate. Quartz Assy. Drawing	
Piirt. 28.05.90 V Kal		Pilot plant Reactor		Ent.	Uusi	
Suunn. SH				25.00.030.40 (90.584 L)		
Tark. SH 30.5.90 SH		Massa kg				
Hyv.						

ASM MICROCHEMISTRY OY

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Seq 3	Seq 2	Seq 1	Water Valve	Ti	N2	H20	N2
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						2/8	2/8

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